WHAT IS CLAIMED IS:

1. A method for removing blocking artifacts in a coding system of a moving picture comprising the steps of:

determining a plurality of pixel sets around a block boundary;

selecting one of a first mode and a second mode as a deblocking mode based on a degree of blocking artifacts;

performing an analysis, if the first mode is selected, comprising,

obtaining frequency information for each of the plurality of pixel sets,

replacing a magnitude of at least one discontinuous component in the frequency domain of a selected pixel set of the plurality of pixel sets belonging to the block boundary with a magnitude of at least one corresponding discontinuous component belonging to a replacement pixel set of the plurality of pixel sets near the block boundary, and

applying the replaced frequency information of the selected pixel set to the spatial domain to remove the blocking artifacts; and

removing the blocking artifacts in the second mode, if the second mode is selected and a second mode condition is satisfied.

2. The method as claimed in claim 1, wherein the magnitude of the discontinuous component of the selected pixel set is replaced with a minimum value of

18

a magnitude of discontinuous components of one of a first pixel set and a second pixel set when the selected pixel set is located across the block boundary and the first and second pixel sets are located within a block adjacent the block boundary.

3. The method of claim 1, further comprising determining a mode decision value, wherein the second mode is selected if the mode decision value is greater than a first threshold value.

4. The method as claimed in claim 3, wherein mode decision value is determined based on the following equation:

mode decision value = $\phi(v_0 - v_1) + \phi(v_1 - v_2) + \phi(v_2 - v_3) + \phi(v_3 - v_4) + \phi(v_4 - v_5) + \phi(v_5 - v_1) + \phi(v_7 - v_8) + \phi(v_8 - v_9)$, wherein $\phi(\gamma) = 1$ when $|\gamma| \leq$ a second threshold value and $\phi(\gamma) = 0$ otherwise, and wherein v_0-v_9 are boundary pixel values.

5. The method as claimed in claim 1, wherein the second mode condition is satisfied when an absolute value of a maximum data value minus a minimum data value in block boundary pixels is smaller than 2QP, wherein the maximum data value = $MAX(v_1, v_2, v_3, v_4, v_5, v_6, v_7, v_8)$, the minimum data value = $MIN(v_1, v_2, v_3, v_4, v_5, v_6, v_7, v_8)$, QP is the quantization parameter of a block adjacent the block boundary and v_1-v_8 are pixels.

6. The method as claimed in claim 1, wherein the second mode performs low pass filtering to remove the blocking artifacts.

7. The method as claimed in claim 1, wherein the deblocking filtering in the default mode is performed by replacing the magnitude of the discontinuous component of pixels v_4 and v_5 that sandwich the block boundary with v_4' and v_5', according to the following equation:

$$v_4' = v_4 - d$$

$$v_5' = v_5 + d$$

$$d = CLIP(c_2.(a_{3,0}' - a_{3,0})//c_3, 0, (v_4 - v_5)/2)*\delta(|a_{3,0}| < QP$$

$$a_{3,0}' = SIGN(a_{3,0})*MIN(|a_{3,0}|, |a_{3,1}|, |a_{3,2}|)$$

$$a_{3,0} = ([c_1\ {-c_2}\ c_2\ {-c_1}]*[v_3 v_4 v_5 v_6]^T)//c_3$$

$$a_{3,1} = ([c_1\ {-c_2}\ c_2\ {-c_1}]*[v_1 v_2 v_3 v_4]^T)//c_3$$

$$a_{3,2} = ([c_1\ {-c_2}\ c_2\ {-c_1}]*[v_5 v_6 v_7 v_8]^T)//c_3,$$

where QP is the quantization parameter of the block containing the pixel v_5, values c_1, c_2, c_3 are kernel constants used in a DCT, and values of $a_{3,0}$, $a_{3,1}$, $a_{3,2}$ are the discontinuous component in each of the plurality of pixel sets, respectively.

8. The method as claimed in claim 7, wherein c_1 and c_2 are approximated to an integer and c_3 is approximated to a multiple of 2, wherein the DCT is a 4-point DCT used

to determine the frequency information, and wherein $a_{3,0}$, $a_{3,1}$, $a_{3,2}$ are evaluated from an inner product of the DCT kernel and the selected pixel set being S0, a first pixel set S1 and a second pixel set S2.

9. The method as claimed in claim 7, wherein $|a_{3,0}| < QP$ prevents over-smoothing.

10. The method as claimed in claim 1, further comprising performing the deblocking filtering process around horizontal and vertical block boundaries in a frame.

11. The method of claim 1, wherein the removing blocking artifacts in the second mode satisfies the following equation:

T0210

$$v_n = \sum_{k=-4}^{4} b_k \cdot p_{n+k}, \quad 1 \le n \le 8$$

$$P_m = (|v_1 - v_0| < QP) \; ? \; v_0 : v_1,$$

if $m < 1$;

v_m, if $1 \le m \le 8$;

$(|v_8 - v_9| < QP)\ v_9 : v_8$, if $m > 8$;

$\{b_k : -4 \le k \le 4\} = \{1,1,2,2,4,2,2,1,1\}//16$,

where v_0-v_9 are boundary pixels, QP is the quantization parameter of a block adjacent the block boundary, and v_n is an adjusted pixel value.

12. The method of claim 1, wherein the replacement pixel set contains a minimum magnitude of the at least one corresponding discontinuous component.

13. The method of claim 1, wherein the first mode is the default mode and the second mode is the DC offset mode, and wherein each of the plurality of pixel sets has four pixels.

14. A method for removing blocking artifacts in a coding system comprising:

determining at least pixel sets S0, S1, S2 around a block boundary;

selecting one of a default mode and a DC offset mode as a deblocking mode based on an amount of blocking artifacts;

deblocking filtering of pixels adjacent the block boundary if the default mode is selected; and

removing artifacts in the DC offset mode, if the DC offset mode is selected and a DC offset mode condition is satisfied, wherein the artifacts are removed in the DC offset mode according to the following equation:

22

T0230

$$v_n = \sum_{k=-4}^{4} b_k \cdot p_{n+k},\ 1 \le n \le 8$$

$$p_m = (|v_1 - v_0| < QP)\ ?\ v_0 : v_1,$$

if $m < 1$;

v_m, if $1 \le m \le 8$;

$(|v_8 - v_9| < QP)\ v_9 : v_8$, if $m > 8$;

$\{b_k : -4 \le k \le 4\} = \{1,1,2,2,4,2,2,1,1\}//16,$

wherein v_o-v_9 are boundary pixels, QP is the quanatation parameter of a block adjacent the block boundary, and v_n is an adjusted pixel value.

15. The method of claim 14, wherein the deblocking filtering step comprises:

obtaining frequency information for each of the plurality of pixel sets S0, S1, S2;

replacing a magnitude of at least one discontinuous component in the frequency domain of a selected pixel set S0 of the plurality of pixel sets belonging to the block boundary with a magnitude of at least one corresponding discontinuous component

belonging to a replacement pixel set S1, S2 of the plurality of pixel sets near the block boundary; and

applying the replaced frequency information of the selected pixel set S0 to the spatial domain to remove the blocking artifacts.

16. The method of claim 14, further comprising determining a mode decision value, wherein the DC offset mode is selected if the mode decision value is greater than a first threshold value, wherein mode decision value is determined based on the following equation:

mode decision value $= \phi(v_0 - v_1) + \phi(v_1 - v_2) + \phi(v_2 - v_3) + \phi(v_3 - v_4) + \phi(v_4 - v_5) + \phi(v_5 - v_1) + \phi(v_7 - v_8) + \phi(v_8 - v_9)$, wherein $\phi(\gamma) = 1$ when $|\gamma| \leq$ a second threshold value and $\phi(\gamma) = 0$ otherwise, and wherein v_0-v_9 are boundary pixel values.

17. The method of claim 14, wherein the DC offset mode condition is satisfied when an absolute value of a maximum data value minus a minimum data value in block boundary pixels is smaller than 2QP, wherein the maximum data value $= \mathrm{MAX}(v_1, v_2, v_3, v_4, v_5, v_6, v_7, v_8)$, the minimum data value $= \mathrm{MIN}(v_1, v_2, v_3, v_4, v_5, v_6, v_7, v_8)$, QP is the quantization parameter of a block adjacent the block boundary and v_1-v_8 are the block boundary pixels.

18. The method of claim 14, wherein the deblocking filtering in the default mode is performed by replacing the magnitude of the discontinuous component of pixels v_4 and v_5 sandwiching the block boundary with v_4' and v_5', according to the following equation:

$$v_4' = v_4 - d$$

$$v_5' = v_5 + d$$

$$d = \mathrm{CLIP}(c_2.(a_{3,0}' - a_{3,0})//c_3, 0, (v_4 - v_5)/2)*\delta(|a_{3,0}| < QP$$

$$a_{3,0}' = \mathrm{SIGN}(a_{3,0})*\mathrm{MIN}(|a_{3,0}|, |a_{3,1}|, |a_{3,2}|)$$

$$a_{3,0} = ([c_1 \ {-c_2} \ c_2 \ {-c_1}]*[v_3 v_4 v_5 v_6]^T)//c_3$$

$$a_{3,1} = ([c_1 \ {-c_2} \ c_2 \ {-c_1}]*[v_1 v_2 v_3 v_4]^T)//c_3$$

$$a_{3,2} = ([c_1 \ {-c_2} \ c_2 \ {-c_1}]*[v_5 v_6 v_7 v_8]^T)//c_3,$$

where QP is the quantization parameter of the block containing the pixel v_5, values c_1, c_2, c_3 are kernel constants used in a 4-point DCT, and values of $a_{3,0}$, $a_{3,1}$, $a_{3,2}$ are based on a simple inner product of the DCT kernel and the selected pixel set S0, a first pixel set S1 and the second pixel set S2.

19. The method of claim 14, further comprising performing the determining through removing steps for each horizontal and vertical block boundaries in a frame.